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Description

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a device for monitoring the dispensing of medication to patients. More particularly it relates to a system for accurately detecting drug dispensing events.

Description of the Prior Art

A variety of devices and methods have been described for controlling, noting, and keeping track of dispensation of medicines to patients. These devices range from simple mechanical checklist systems, through pill containers equipped with alarm clocks and the like and pill containers having timer-controlled latching devices which regulate the patient's access to medication. Some typical examples of these devices include the timed medication dispenser described by Roy J. Machamer in United States Patent No. 4,382,688 which shows a medical dispenser having an electronic reminder to take the medication it contains. In this device the electronic reminder is disabled when the user takes the medication. In United States Patent No. 4,448,541, Jonathan D. Wirtschafter describes a magnetically responsive switch device which is activated when a medication dispenser is opened so as to give an indication of the drug dispensing event. United States Patent. No. 4,367,955 of Donald H. Ballew shows a combined timer and container for dispensing medications wherein the container and its lid coact to initiate the timer cycle upon interengagement of the cap and container. United States Patent No. 4,034,757 of Glover shows a device having two switches, each of which must be activated simultaneously to register a drug delivery event.

The foregoing patents are merely representative. Other background patents relating to medication dispensers include for example United States Patent No. 3,369,697 of Glucksman et al.; 3,395,829 of Cogdell et al.; 3,651,984 of Redenbach; 3,722,739 of Blumberg; 3,762,601 of McLaughlin; 3,815,780 of Bauer; 3,911,856 of Ewing; 3,917,045 of Williams; 3,968,900 of Stambuk; 3,998,356 of Christensen; 4,207,992 of Brown; 4,223,801 of Carlson; 4,258,354 of Carmon et al.;4,275,384 of Hicks et al.; 4,360,125 of Martindale et al.; 4,361,408 of Wirtschafter; 4,382,688 of Machamer; 4,419,016 of Zoltan; 4,448,541 Wirtschafter; 4,473,884 of Behl; 4,483,626 of Nobel; 4,490,711 of Johnston; 4,504,153 of Schollmeyer et al. and 4,526,474 of Simon.

In the case of devices with which it is desired to monitor access to a multidose drug container it is of importance to be able to identify true access events and distinguish them from false events. A true event would include opening the container, removing a pill or other medicament and then closing the container. A false event could include leaving the container open and repeatedly removing pills or, in the case of the not-sure-handed, repeated attempts at reinstalling the cap after a single removal of a drug or dropping the closed container, thereby actuating the open-close switch by means of the force of impact.

It is an object of this invention to provide a detection system which will be capable of identifying true drug removal events and discriminating them from these false events.

It is important that a device capable of electronically identifying and recording drug dosing information be constructed in a manner which is sturdy and reliable. It is also important that the construction be such as to minimise even inadvertent contact between the medication contained in the device and the various electronic elements which nose and record dosing information. This avoids contamination of the drug by contact with the electronic component, on the one hand, and interference with the proper functioning of the electronics by contact with the drug, on the other. The construction should also minimise cost and advantageously permit reuse of expensive electronic components. To these ends, it is a further object of this invention to provide a device for measuring and recording drug dosing information which physically separates the majority of the electronic components from the drug storage chamber. It is also an object of this invention to provide a device in which major electronic components can be recycled.

US-A-4 588 303 discloses a device for detecting the dispensing of a drug from a container as specified in the prior art portion of claim 1. A similar device is disclosed in FR-A-2 611 671.

Both these prior art proposals are typical of drug dispensing containers in which a record is kept of the dispensing of drugs in order to maintain a particular time regime, with dispensing of the drugs being controlled or recorded for dispensing within particular time intervals. What these prior art devices do not do is to have anything to give a good indication that a drug has actually been dispensed and that there has not been some false reading and as such are quite typical of the prior art referred to above. The present invention, as defined in claim 1, is directed at the provision of means to give a reasonable determination of the likelihood of a drug having been dispensed, when the lid of the container is opened. This, thus, provides a reliable indication that the drug has actually been dispensed and it is this reliable indication

which can then be used to provide such signals as are necessary to monitor the correct timing between different doses.

In general terms, the present invention provides a device which is capable of discriminating between true and false drug dispensing events. This device includes a drug container having an openable and reclosable cap, lid or other similar dispensing aperture. The container is equipped with a detector which generates a first electrical signal in response to the opening of the dispensing aperture and a second electrical signal in response to the reclosing of the aperture. The device additionally includes a timing mechanism which measures the time elapsed between the first electrical signal and the second electrical signal. The elapsed time is then compared to a predetermined accept/reject standard. Times shorter than the accepted range, and thus indicative of fumbling with the cap or an impact event, are rejected. In preferred embodiments times longer than the accepted range and thus indicative of an open container can also be rejected. In other embodiments the device can measure the time between a closing and the next opening and compare that period to a standard to validate a drug dispensing event. A time meeting the preset criteria, such as falling within the desired range, is considered to be a good indication of a true drug-dispensing event. The device further includes a system for using these indications of true drug-dispensing events. This system of use can include a memory for storing the number of such events. It can also include a timekeeping mechanism which can provide and record the time and date each time an elapsed time within the accept range is determined. The information so determined and stored can be accessed by the pharmacist, physician or other health care professional as needed to verify compliance with dosing regimens, to give an indication of the patient's condition, or the like. In alternative embodiments, the determination that an elapsed time has fallen outside the accept range can be used to activate an alarm, to deliver a message to the patient or to the patient's health care professional or to alter the delivery pattern of drugs from the device such as by disabling the ability of the device to deliver drug or the like.

In other aspects, this invention provides an improved construction for an electronic medication monitor. In this preferred construction, the electronics are present in a removable cap for a medication container. In this construction all the electronics, except for a switch, are isolated from the drug container so that contamination between the electronics and the drug is avoided. In other aspects, the electronics are positioned so that expensive components may be removed and recycled. In yet a further aspect, the device of this invention can include an electronic access port through which data and program information is loaded and off-loaded wherein this access port is in the form of a plurality of electrically conductive pads which are accessed by spring-loaded pins in a suitable probe.

DETAILED DESCRIPTION OF THE INVENTION

Brief Description of the Drawings

The present invention will be further described with reference being made to the accompanying drawings in which:

Fig. 1 is a perspective elevational view of a pill container incorporating the present invention.

Fig. 2 is a cutaway of the device shown in Fig. 1.

Fig. 3 is a simple circuit diagram of one form of electronics usable as part of the present invention.

Fig. 4 is an exploded cross-sectional side view of a cap for a drug container, which cap contains the electronics necessary for noting and recording drug delivery in accord with this invention.

Fig. 5 is a cross-sectional side view of the cap of Fig. 4 in unexploded format.

Fig. 6 is a top view of the cap of Fig. 4.

Fig. 7 is a cross-sectional view of a probe pin useful for making electrical contact with the electronic circuitry of the cap of Fig. 4 for data output or program input.

Description of Preferred Embodiments

Turning first to the drawings, in Figs. 1 and 2, a drug container 10 is illustrated as including a pill vial 11 and removable/reclosable cap 12. Cap 12 serves as a drug access port and in the embodiment shown additionally includes an optional optical readout 13 which can be used to display messages, signals or the like. Container 10 can take on a variety of configurations. It can be a dry pill container, as shown, a fluid drug container with a removable or openable cap, an aerosol with its dispensing nozzle carried under a removable/replaceable cover, or the like. In any embodiment, device 10 includes means for noting opening and closing of the drug access port. This can take the form of switch 21 which is physically engaged when the top 12 is placed on vial 11 and which is disengaged when it is removed. Of course, other functionally equivalent magnet switches or the like could be used so long as they give an accurate indication of the opening and the closing of the drug container. The output of switch 21 is fed to

circuit board 22. Latching tabs 23 are used to fasten the top to the vial.

The signal so generated by switch 21 is fed into an electronic circuit such as shown in Fig. 3. In Fig. 3, 3-volt power is supplied by lithium battery 30 to a variety of locations in the circuit, as noted in legend VCC. The circuit employs a general purpose microprocessor 32. A 32 kHz clock crystal frequency is fed to pins X1 and X2 of microprocessor 32.

An active analog filter, constructed to set the pair of times which validate an opening, is coupled to pin P60 of microprocessor 32. This filter functions as follows–when the cap is removed, switch 21 is closed. This sends current through resistor 34 to capacitor 36. This resistor and capacitor are matched so that it takes about 0.5 seconds for the capacitor to charge to a threshold voltage which can be read by the microprocessor. If the switch was not closed for at least this period, as would be the case with an instantaneous closing, such as if the device were dropped, an adequate charge to indicate cap removal would not be generated, and the microprocessor would not be signaled that the cap had been removed. As will be appreciated, resistor 34 and capacitor 36 can be altered in value to give other time constants, if desired.

After a "cap off" signal has been sent to the microprocessor, pin P60 remains above the threshold voltage. When the cap is replaced, eliminating the voltage source through resistor 34, capacitor 36 is drained at a set rate through resistor 38 to ground 40. The value of resistor 38 is selected in this particular case so that the voltage drains past the threshold voltage. In the circuit shown, this takes about 2 seconds. At that time, pin P60 notes that the cap has been replaced. Thus, the device provides that a valid cap closing occurs after 2 seconds. If the cap were to be jiggled back open, this would cause current to flow through switch 21 and resistor 34 to maintain pin P60 at a "cap open" voltage.

Returning to microprocessor 32, it is a general purpose which contains an internal clock function. It also contains a small amount of RAM and about 2K of 8-bit ROM. This contains custom code which is used to communicate with RAM memory 42 drug delivery information generated by the actuation of switch 21 and filtered with the validation circuit is stored in RAM 42 together with time information supplied by microprocessor 32. This information is accessible through data point 44. It may be used by the health care professional to determine dosage times so as to validate correct dosing or to determine incorrect dosing.

The time interval between opening and reclosing the top of drug container 10 has been shown to be measured and compared to a predetermined standard. In the case shown, if the time between the two events is shorter than about 0.5 seconds, the system logic determines that in fact the top was not removed and a drug dose was not dispensed simply because that time was too short. This event would be classed as an inadvertent or error signal. No indication of drug dosing would be noted. Similarly, if the time interval between the closing and the subsequent opening is too short, for example, less than about 2 seconds, the device will not register the event as a true closing of the device and instead record the event as a mere fumbling with the cap or the like. The device can additionally be equipped to compare the interval between a valid opening and valid closing an provide an indication as to whether or not this interval is consistent with a single dosing or not. Too long an interval would suggest that the device was left open for an extended period and that possibly multiple doses were taken. In a variation, the device may contain information indicating the usual time between successive doses. If the time period between a valid opening and a valid closing far exceeded the normal period of a few seconds, but rather corresponded to the period between successive doses, the device could be equipped to indicate the logical conclusion that the device was opened, a dose taken, and the device not reclosed until a subsequent time when a second dose was taken.

Correct drug dispensing events, that is a proper opening and a proper closing separated in time by a proper interval can be stored into a readable memory for use by the health care professional to verify proper dosing or to identify dosing errors. Incorrect events may in some cases be disregarded or may be noted in the memory as well, preferably with a suitable notation regarding their incorrectness, also for use by the health care professional. The correct and incorrect opening and closing information can also be used on an interactive basis such as to modify the dosing regimen, to send signals to the patient or the health care professional alerting them of changes or deviations from the desired or expected regimen or the like.

Although not intended as a limitation on the structure of the device in which the present time filtering is employed, the device of Figs. 1 and 2 can have several other useful features. These features, which find application in other drug compliance monitors, as well, are shown in Figs. 4 through 7.

One such advantageous feature is to have a construction which separates the drug from the electronics of the medication event monitor. If the drug and electronics are allowed to come into contact with one another the drug may interfere with the electronics or the electronics may contami-

nate the drug such as by releasing noxious or toxic materials into the drugs. In the embodiment shown in Figs. 4-6 the electronics are isolated in the cap of the drug dispenser. In this embodiment the cap 12 includes a cap body 41 having a continuous barrier 42. Barrier 42 has holes 43 and 43a through which electronic wires can be passed. The electronics employed in the device, save and except for a single switch 46 which is physically activated when the cap is removed or replaced on the drug container, are carried on a printed circuit board 45 which fits into body 41. Cap liner 48 is present shielding the switch 46 from the drug storage region. When the cap is placed on the drug container, the top lip of the container presses against the liner 48 and forces it upwards against the switch 46 causing it to open or close. The two leads on switch 46 pass through holes 43 and 43a and seal these holes, preferably so that there is no possible contact between the drug contained in the device with the electronics. A cap lid 49 is present covering the electronics. It is overlaid with a label 50 which can carry information about the drug, the device or the like.

Another useful feature of the device of this invention when configured as shown in Figs. 4-5 is the ability to recycle electronics. The electronic circuitry employed in the present invention is relatively costly as it contains at least one general purpose microprocessor chip. While it is generally not preferred to reuse drug containers for a sequence of drugs, for fear of some risk or cross contamination, no matter how remote, it would be desirable to recycle the electronics. In the configuration shown, the single switch 46 can be uncoupled by removing two connections and then the entire electronics board, which has not been in contact with drug, can be removed and recycled.

Yet an additional feature of this preferred embodiment is shown with special reference to Figs. 6 and 7. This feature relates to the way data is extracted from the memory of the device and programs are fed into the memory of the device. One typical way to do this is to use a telephone jack or the like. A preferred method is shown in the figures where a simpler less space consumptive coupling is shown. In this embodiment the coupling is effected through a plurality of electrically conductive pads 51, 51a, 51b, etc. these are aligned with a corresponding plurality of holes 52, 52a, 52b, etc in the cap lid 49. They also correspond in position to a plurality of spring-loaded pins 54, 54a, 54b, etc in a data probe 55. In use, the pins are thrust through the label 50, through the holes 52 until the sharp ends of the pins 54 contact the conductive pads 51. The pin 54 is loaded with spring 56 and held in place by stop 57 so that a firm engagement between the pin and the pad is possible. Conductor 58 carries data from the devices memory or feed program to the device, as appropriate. Fig. 7 shows a top view of one form of hole arrangement. In the arrangement shown, there are 5 holes, arranged i a configuration which allows only a single orientation of coupling of the connector. These five holes are located in a particular position relative to registration mark 59. In actual use, the cap could be placed in an automated reader of some sort with registration mark 59 properly aligned with a corresponding position in the reader. Then the test pins 54 could automatically align with and access the conductive pads through holes 52. This configuration has the advantages of small size, and low cost.

Claims

1. A device for detecting the dispensing of drug from a container (10) comprising a container (10) having an openable and reclosable dispensing aperture, means (21) capable of generating a first electrical signal in response to the opening of the openable aperture, means (34,36) for measuring an elapsed time after said first electrical signal, and means (32) for comparing the elapsed time with a predetermined time range and determining if the elapsed time falls within the time range, characterised in that means (23) are included for generating a second electrical time indicative signal in response to the reclosing of the aperture, in that the elapsed time measured is that between said first and second electrical signals, in that the predetermined time range is an accept/reject time range and the comparing means (32) determines whether the elapsed time falls within the accept range, and in that means (42) are provided for recording each time an elapsed time within the accept range is determined.

2. A device according to claim 1, wherein the predetermined accept/reject time range is a time range having a minimum boundary of about 0.5 seconds.

3. A device according to claim 1 or 2, wherein the recording is noted as a valid dispensing of drug from the container (10).

4. A device according to claim 1, 2 or 3, additionally comprising means (36,38) for measuring a second elapsed time between the second electrical signal and the next subsequent first electrical signal, means (32) for comparing the second elapsed time with a second predetermined accept/reject time range and determin-

ing if the elapsed time falls within that second accept range, and means (42) for recording each time an elapsed time within the second accept range is determined.

5. A device according to claim 4, wherein the second predetermined accept/reject time range is a time range having a minimum boundary of about 2 seconds.

6. A device according to claim 5, wherein the recording of the occurrence of the elapsed time within the second predetermined time range is noted as a valid closing of the container (10).

7. A device according to claim 4, 5 or 6, additionally comprising means (42) for recording openings or closings of the container (10) which fall outside the accept range.

8. A device according to any one of claims 4, 5 or 6, additionally comprising means (13) for alerting the patient when the elapsed time is larger than the accept range.

9. A device according to any one of claims 4 to 8, additionally comprising means (52) for informing the patient's health care professional when an elapsed time outside the accept range has been detected.

10. A device according to any preceding claim, which includes a closure (12) for said aperture, said closure also defining a volume in which is housed means (45) capable of generating the electrical signals in response to the opening and/or reclosing of the aperture, as well as the means for noting and recording the time at which the electrical signal is generated, said means (45) for noting and recording being physically separated from the drug in the drug storage container (10).

11. A device according to claim 10, wherein said means capable of generating the first electrical signal is a switch (21) which is activated when the closure is removed from the container.

12. A device according to any preceding claim, wherein said means capable of generating the second electrical signal is a switch (21) which is activated when the closure is replaced on the container.

13. A device according to any preceding claim, wherein a plurality of conductive pads (51) located within said device and accessible by a corresponding plurality of pointed probe pins (54) are provided as a data port through which information regarding detection of the event of delivery of a drug dose can be read.

Patentansprüche

1. Vorrichtung zur Erfassung der Ausgabe eines Arzneimittels aus einem Behälter (10), mit einem Behälter (10), der eine Ausgabeöffnung aufweist, die geöffnet und wieder geschlossen werden kann, Mitteln (21), die ein erstes elektrisches Signal in Reaktion auf das Öffnen der Öffnung, die geöffnet werden kann, erzeugen können, Mitteln (34, 36), die eine Zeit messen können, die seit dem ersten elektrischen Signal verstrichen ist, und Mitteln (32), die dazu dienen, die verstrichene Zeit mit einer vorbestimmten Zeitspanne zu vergleichen, und zu bestimmen, ob die verstrichene Zeit in der Zeitspanne liegt, dadurch gekennzeichnet, daß die Mitte (23) vorgesehen sind, um ein zweites, die Zeit angebendes elektrisches Signal in Reaktion auf das Wiederverschließen der Öffnung zu erzeugen, daß die gemessene verstrichene Zeit die Zeit zwischen den ersten und zweiten elektrischen Signalen ist, daß die vorbestimmte Zeitspanne eine Akzeptanz-/Ablehnungszeitspanneist und das Vergleichsmittel (32) bestimmt, ob die verstrichene Zeit in die Akzeptanzspanne fällt, und daß Mittel (42) vorgesehen sind, die jeden Zeitpunkt registrieren, an dem eine verstrichene Zeit in der Akzeptanzspanne festgestellt wird.

2. Vorrichtung nach Anspruch 1, bei der die vorbestimmte Akzeptanz-/Ablehnungszeitspanne eine Zeitspanne ist, die eine Mindestbegrenzung von etwa 0,5 Sekunden aufweist.

3. Vorrichtung nach Anspruch 1 oder 2, bei der das Registrieren als eine zulässige Ausgabe des Arzneimittels aus dem Behälter (10) vermerkt wird.

4. Vorrichtung nach Anspruch 1, 2 oder 3, zusätzlich mit Mitteln (36, 38) zum Messen einer zweiten verstrichenen Zeit zwischen dem zweiten elektrischen Signal und dem nächsten nachfolgenden ersten elektrischen Signal, Mitteln (32) zum Vergleichen der zweiten verstrichenen Zeit mit einer zweiten vorbestimmten Akzeptanz-/Ablehnungszeitspanne und zum Bestimmen, ob die verstrichene Zeit in die zweite Akzeptanzspanne fällt, und Mitteln (42) zum Registrieren jedes Zeitpunkts, an dem eine verstrichene Zeit in der zweiten Akzeptanzspanne festgestellt wird.

5. Vorrichtung nach Anspruch 4, bei der die zweite vorbestimmte Akzeptanz-/Ablehnungszeitspanne eine Zeitspanne ist, die eine Mindestbegrenzung von etwa 2 Sekunden aufweist.

6. Vorrichtung nach Anspruch 5, bei der das Registrieren des Auftretens der verstrichenen Zeit in der zweiten vorbestimmten Zeitspanne als ein zulässiges Schließen des Behälters (10) vermerkt wird.

7. Vorrichtung nach Anspruch 4, 5 oder 6, zusätzlich mit Mitteln (42), die registrieren, wenn der Behälter (10) außerhalb dieser Akzeptanzspanne geöffnet oder geschlossen wird.

8. Vorrichtung nach einem der Ansprüche 4, 5 oder 6, zusätzlich mit Mitteln (13) zum Alarmieren des Patienten, wenn die verstrichene Zeit größer als die Akzeptanzspanne ist.

9. Vorrichtung nach einem der Ansprüche 4 bis 8, zusätzlich mit Mitteln (52) zum Informieren der Person, die für die fachliche medizinische Betreuung des Patienten zuständig ist, wenn eine verstrichene Zeit außerhalb der Akzeptanzspanne erfaßt worden ist.

10. Vorrichtung nach einem der vorhergehenden Ansprüche, die einen Verschluß (12) für die Öffnung umfaßt, wobei der Verschluß auch ein Volumen begrenzt, in dem Mittel (45) untergebracht sind, die die elektrischen Signale in Reaktion auf das Öffnen und/oder Wiederverschließen der Öffnung erzeugen können, sowie auch die Mittel zum Vermerken und Registrieren der Zeit, in der das elektrische Signal erzeugt wird, wobei die Mittel (45) zum Vermerken und Registrieren physisch von dem Arzneimittel in dem Arzneimittelspeicherbehälter (10) getrennt sind.

11. Vorrichtung nach Anspruch 10, bei der das Mittel, das das erste elektrische Signal erzeugen kann, ein Schalter (21) ist, der aktiviert wird, wenn der Verschluß von dem Behälter entfernt wird.

12. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der das Mittel, das das zweite elektrische Signal erzeugen kann, ein Schalter (21) ist, der aktiviert wird, wenn der Verschluß wieder auf dem Behälter plaziert wird.

13. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der eine Vielzahl von leitenden Stegen (51), die sich in der Vorrichtung befinden und durch eine entsprechende Vielzahl von spitz zulaufenden Sondenstiften (54) zugänglich sind, als ein Datenanschluß vorgesehen sind, durch den Informationen bezüglich der Erfassung des Ereignisses einer Abgabe einer Arzneimitteldosis gelesen werden können.

Revendications

1. Dispositif de détection de la délivrance d'un médicament depuis un récipient (10), comportant un récipient (10) possédant une ouverture de distribution pouvant être ouverte et refermée, des moyens (21) aptes à produire un premier signal électrique en réponse à l'ouverture de l'ouverture pouvant être ouverte, des moyens (34, 36) pour mesurer un temps écoulé après ledit premier-signal électrique, et des moyens (32) pour comparer le temps écoulé à une plage de temps prédéterminée et déterminer si le temps écoulé se trouve à l'intérieur de la plage de temps, caractérisé en ce que des moyens (23) sont prévus pour produire un second signal électrique représentatif du temps en réponse à la refermeture de l'ouverture, en ce que le temps écoulé mesuré est celui entre lesdits premier et second signaux électriques, en ce que la plage de temps prédéterminée est une plage de temps d'acceptation/rejet et les moyens de comparaison (32) déterminent si le temps écoulé se trouve à l'intérieur de la plage d'acceptation, et en ce que des moyens (42) sont prévus pour enregistrer chaque fois qu'un temps écoulé à l'intérieur de la plage d'acceptation est déterminé.

2. Dispositif selon la revendication 1, caractérisé en ce que la plage de temps d'acceptation/rejet prédéterminée est une plage de temps ayant une limite minimum d'environ 0,5 seconde.

3. Dispositif selon la revendication 1 ou 2, dans lequel l'enregistrement est noté en tant que délivrance valide de médicament depuis le récipient (10).

4. Dispositif selon la revendication 1, 2 ou 3, comprenant en outre des moyens (36, 38) pour mesurer un second temps écoulé entre le second signal électrique et le premier signal électrique immédiatement suivant, des moyens (32) pour comparer le second temps écoulé à une seconde plage de temps d'acceptation/rejet prédéterminée et déterminer si le temps écoulé se trouve à l'intérieur de la seconde plage d'acceptation, et des moyens (42) pour enregistrer chaque fois qu'un temps

écoulé à l'intérieur de la seconde plage d'acceptation est déterminé.

5. Dispositif selon la revendication 4, dans lequel la seconde plage de temps d'acceptation/rejet prédéterminée est une plage de temps ayant une limite minimum d'environ 2 secondes.

6. Dispositif selon la revendication 5, dans lequel l'enregistrement de l'apparition du temps écoulé à l'intérieur de la seconde plage de temps prédéterminée est noté en tant que fermeture valide du récipient (10).

7. Dispositif selon la revendication 4, 5 ou 6, comprenant en outre des moyens (42) pour enregistrer des ouvertures ou des fermetures du récipient (10) qui se trouvent à l'extérieur de la plage d'acceptation.

8. Dispositif selon l'une quelconque des revendications 4, 5 ou 6, comprenant en outre des moyens (13) pour avertir le malade lorsque le temps écoulé est supérieur à la plage d'acceptation.

9. Dispositif selon l'une quelconque des revendications 4 à 8, comprenant en outre des moyens (52) pour informer le personnel de santé du malade lorsqu'un temps écoulé à l'extérieur de la plage d'acceptation a été détecté.

10. Dispositif selon l'une quelconque des revendications précédentes, comprenant une fermeture (12) pour ladite ouverture, ladite fermeture définissant également un volume dans lequel sont logés des moyens (45) aptes à produire les signaux électriques en réponse à l'ouverture et/ou la refermeture de l'ouverture, ainsi que les moyens pour noter et enregistrer l'instant auquel le signal électrique est produit, lesdits moyens (45) pour noter et enregistrer étant physiquement séparés du médicament dans le récipient de stockage du médicament (10).

11. Dispositif selon la revendication 10, dans lequel lesdits moyens aptes à produire le premier signal électrique sont un commutateur (21) qui est activé lorsque l'enceinte est retirée du récipient.

12. Dispositif selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens aptes à produire le second signal électrique sont un commutateur (21) qui est activé lorsque la fermeture est remise en place sur le récipient.

13. Dispositif selon l'une quelconque des revendications précédentes, dans lequel une pluralité de plots conducteurs (51) disposés à l'intérieur dudit dispositif et accessibles par une pluralité correspondante de broches pointues (54) sont prévus en tant que port de données par l'intermédiaire duquel une information concernant la détection de la délivrance d'une dose de médicament peut être lue.

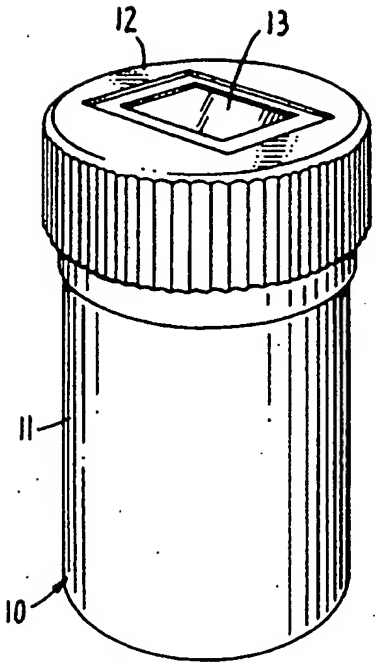


FIG.1.

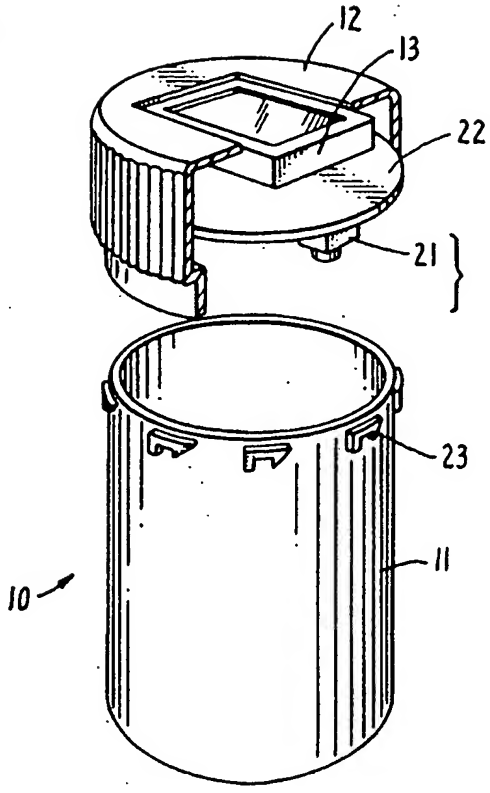


FIG.2.

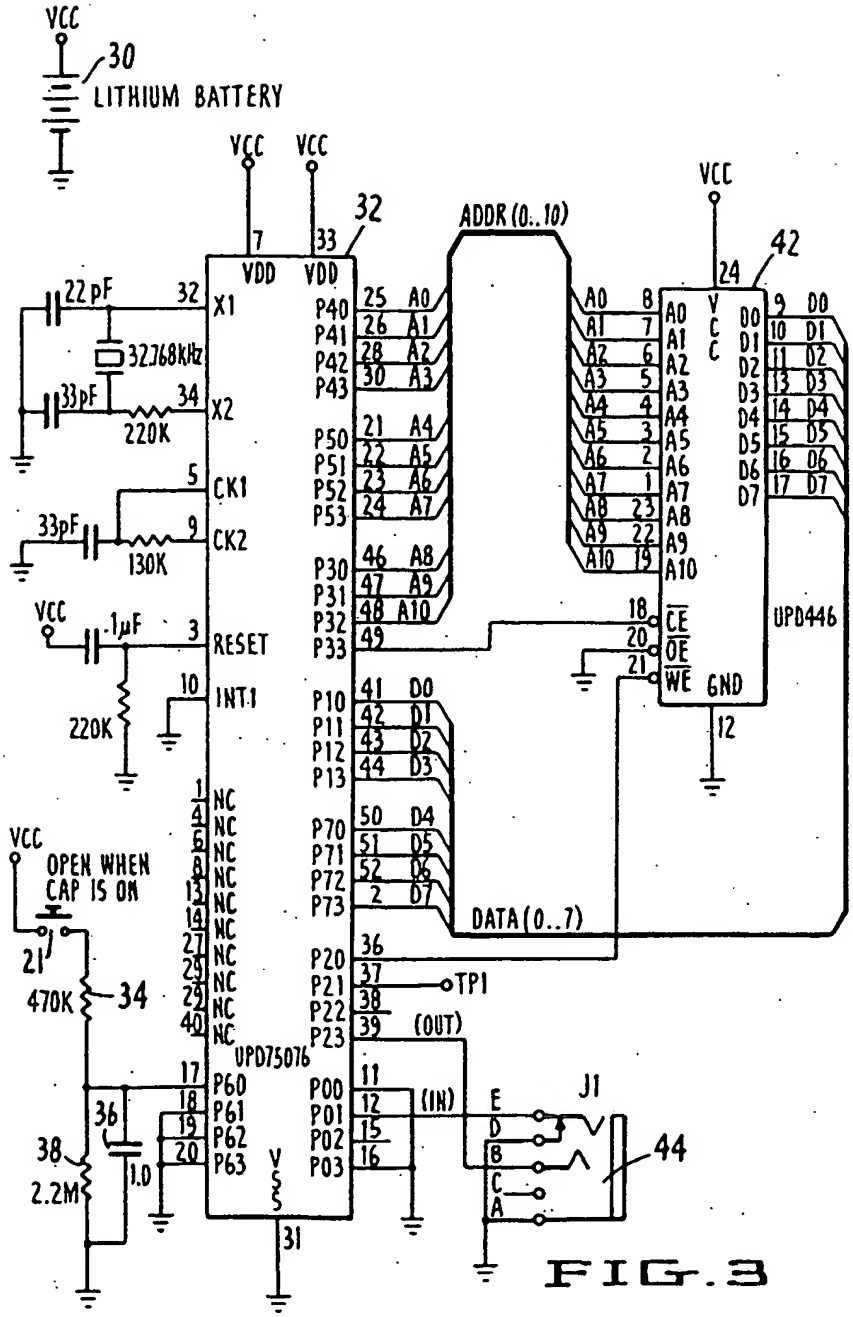

VCC
30
LITHIUM BATTERY
VCC
VCC
32
ADDR(0..10)
VCC
42
7
33
VDD
VDD
24
22pF
32
X1
32768kHz
33pF
34
X2
220K
5
CK1
33pF
9
CK2
130K
VCC
.1μF
3
RESET
10
INT1
220K
1
4
6
8
13
14
27
29
22
40
NC
17
18
19
20
P60
P61
P62
P63
36
38
2.2M
1.0
VCC
OPEN WHEN
CAP IS ON
21
470K
34
31
UPD75076
P40
P41
P42
P43
P50
P51
P52
P53
P30
P31
P32
P33
P10
P11
P12
P13
P70
P71
P72
P73
P20
P21
P22
P23
P00
P01
P02
P03
25 A0
26 A1
28 A2
30 A3
21 A4
22 A5
23 A6
24 A7
46 A8
47 A9
48 A10
49
41 D0
42 D1
43 D2
44 D3
50 D4
51 D5
52 D6
2 D7
36
37
38
39
11
12
15
16
TP1
(OUT)
(IN)
A0 8
A1 7
A2 6
A3 5
A4 4
A5 3
A6 2
A7 1
A8 23
A9 22
A10 19
18 CE
20 OE
21 WE
GND
12
9 D0
10 D1
11 D2
13 D3
14 D4
15 D5
16 D6
17 D7
UPD446
DATA(0..7)
J1
E
D
B
C
A
44

FIG.3

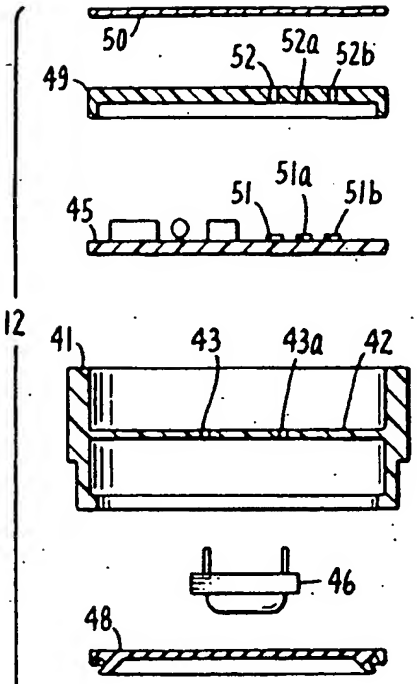


FIG.4.

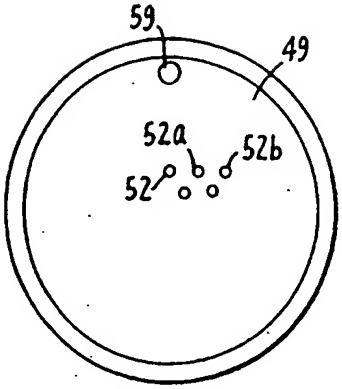


FIG.6.

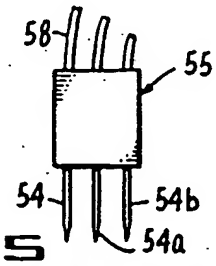
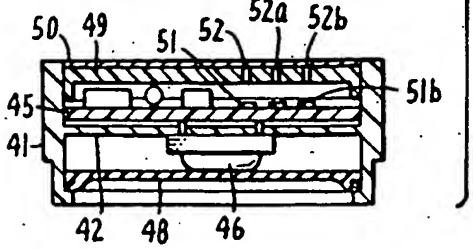


FIG.5



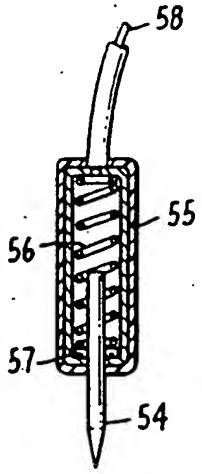


FIG.7.